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Knowledge and practice of family medicine residents towards screening for gestational diabetes and undiagnosed diabetes mellitus in pregnancy, in 1st and 2nd health clusters, Riyadh, Saudi Arabia

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ABSTRACT

Background: We are aiming to assess, compare, and to correlate between the knowledge and practice of family medicine residents towards screening for gestational diabetes and undiagnosed DM in 1st and 2nd health clusters, Riyadh, Kingdom of Saudi Arabia. *Methodology:* This is a quantitative analytic cross-sectional study targeting family medicine residents of 1st and 2nd health clusters, Riyadh, Kingdom of Saudi Arabia. Data were collected using predesigned validated questionnaire. *Results:* In this study, we were able to collect 204 responses for our questionnaire divided into two clusters; cluster 1 consisted of 95 participants (46.6%) and cluster 2 consisted of 109 participants (53.4%). 36.3% of the participants reported that they routinely screen any women for diabetes early in pregnancy at their first visit and the most used test was 75 gm Glucose Tolerance Test (32.8%). 85.3% of the total participants would screen all pregnant women at gestational age of 24 – 28 weeks (P=0.243). *Conclusion:* The study concluded that there was a limited knowledge about screening for undiagnosed diabetes in pregnancy. However, the level of knowledge regarding GDM screening was sufficient.

Keywords: GDM, Undiagnosed diabetes mellitus in pregnancy, Diabetes screening in pregnancy, Family medicine residents, Knowledge, Saudi Arabia.

1. INTRODUCTION

Diabetes mellitus is a prominent healthcare issue worldwide contributing too many adverse health outcomes. According to the World health organization,

the global prevalence of diabetes mellitus in adult population is 8.5% in 2014 (WHO, 2020). However, when it comes to the global GDM prevalence, the lack of standardized screening tests, different diagnostic criteria, and the diversity of each population characteristic all leads to poorly defined prevalence (Zhu & Zhang, 2016). The estimated prevalence of diabetes in the Middle East and North Africa (MENA) is considered 5-10 times greater than the prevalence of diabetes in Western European countries (Al-Rifai et al., 2019). In Saudi Arabia the prevalence of GDM has been estimated to be 12.5% according to WHO criteria (WHO, 2010). The Saudi Abnormal Glucose Metabolism and Diabetes Impact Study (SAUDI-DM) conducted from 2007-2009 nationwide found that 40% of Saudi pregnant female were suffering from either pre-existing DM or GDM (Al-Rubeaan et al., 2014). This high rate is related to many common risk factors including, obesity, and older age more than 30-year-old, previous history of GDM and macrosomia (Al-Rubeaan et al., 2014). Also, Saudi females with pre-existing DM do not have enough knowledge about the preconception care and rarely seek counselling especially in older patients, they are also getting pregnant without planning (Madanat & Sheshah, 2016).

Congenital anomalies of the fetus such as Caudal Regression Syndrome (CRS), neural tube defects (NTD) and ventricular septal defect (VSD) are well known complications of uncontrolled diabetes in early pregnancy. While, fetus over-weight is one of the consequences of poorly controlled diabetes in late pregnancy (Abdelmola et al., 2017). These significant adverse outcomes emphasize the need of preconception counselling for ladies who are at childbearing age, already diagnosed with DM, and planning to conceive. Primary care physicians have an important role in maintaining women's health throughout different ages and status. One of their significant roles is providing an optimal antenatal care for the sake of both mother and fetus. It was found that women with undiagnosed diabetes had frequent visits to their primary care physician prior to or in early pregnancy, but the diagnosis of type 2 diabetes were usually missed (Lee et al., 2020).

Therefore, caregivers should be aware of the possibility of undiagnosed type 2 diabetes in women with high risk, which if detected early and treated aggressively would in return reduce the probability of complications such as perinatal mortality and many other adverse outcomes (Lee et al., 2020). Therefore, in this study, we are aiming to assess, compare, and to correlate between the knowledge and practice of family medicine residents towards screening for gestational diabetes mellitus and undiagnosed DM in 1st and 2nd health clusters, Riyadh, Kingdom of Saudi Arabia.

2. METHODOLOGY

Study design

This is a quantitative analytic cross-sectional study.

Study setting

Family medicine training primary care centers of 1st and 2nd health clusters, Riyadh, Kingdom of Saudi Arabia from December 2020 to December 2021.

Participants/Study Population

Inclusion

The subjects were female and male family medicine residents working at training primary care centers of 1st and 2nd health clusters, Riyadh, Kingdom of Saudi Arabia.

Exclusion

Medical students, interns, nurses, technicians, non-family medicine residents, specialist and consultants were excluded from this study.

Sample size

With a population size of 459, margin of error of 5%, and confidence level of 95%. 210 participates were needed to complete the questionnaire. By anticipating 10% non-response rate from the pilot study, the sample size is increased to 231.

Sampling technique

Subjects were selected by a stratified random sampling technique.

Data collection methods

By using a predesigned anonymous self-administered questionnaire (McLean et al., 2019). The questionnaire adapted to the local context. The first part is about demographic data contains variables such as: age, gender, nationality; other questions about the profession and clinical experience in practicing family medicine. The second part is asking about the number of obstetric patients seen per week, screening for diabetes in different trimesters, its indications and test to be performed in each trimester. The third part is concerning the referral to medical specialists and allied health specialists, indication for referrals, the level of satisfaction with the process of referring and communication. There are some questions about the level of satisfaction with providing different types of diabetes management in pregnancy like giving advice for lifestyle and dietary changes, how to administrate insulin and monitor glucose level.

Pilot study

A pilot study had been carried out to verify the validity, usability, and reliability of the questionnaire. The pilot study, conducted among 21 participants from different genders, training primary care centers, and residency levels. The time needed for filling out the survey was 10 to 15 minutes. The response rate was 90%. All the questions were clear and there were no ambiguities.

Data analysis plan

The collected data were cleaned, entered, and analyzed using Statistical Package for the Social Sciences (SPSS) software version 23. Descriptive statistics (i.e., frequencies, percentages, and measures of central tendency and dispersion where appropriate) were calculated for each item in the survey and for all demographic variables. Means with standard deviations (±SD) for continuous variables and proportions for discrete variables were utilized.

Ethical considerations

The International Review Board of King Fahad Medical City approved the study (21-049) on June 24, 2021. The questionnaire included a cover page explaining the rationale of the research and the informed consent indicates the purpose of the study and all potential risks and benefits.

3. RESULTS

In this study, we were able to collect 204 responses for our questionnaire divided into two clusters. Cluster 1 consisted of 95 participants (46.6%) and cluster 2 consisted of 109 participants (53.4%). In general, 79.9% of the participant's ages ranged between 24 and 29 years old and 52.5% were females. Most of the participants were Saudi (99.0%) and 32.4% of them were at level two of residency while only 17.2% were at level four. 51% of the participants reported seeing 3-5 obstetric patients per week. In table 1, we also compared between the two clusters in demographic factors finding that participants at cluster two were significantly older (P=0.005) and reported seeing less numbers of patients per week (P<0.001) and no other significant difference had been reported.

Table 1 Socio-demographic Characteristics across two Health Clusters

Characteristics	Description	Cluster I [95 (46.6)]	Cluster II [109 (53.4)]	Total [204 (100.0)]	p value
Age (year)	> 35	0 (.0)	6 (5.5)	6 (2.9)	0.005
	24-29	84 (88.4)	79 (72.5)	163 (79.9)	
	30-35	11 (11.6)	24 (22.0)	35 (17.2)	
Gender	Female	43 (45.3)	64 (58.7)	107 (52.5)	0.055
	Male	52 (54.7)	45 (41.3)	97 (47.5)	
Nationality	Non-Saudi	0 (.0)	2 (1.8)	2 (1.0)	0.5
	Saudi	95 (100.0)	107 (98.2)	202 (99.0)	
Resident Level	R1	21 (22.1)	22 (20.2)	43 (21.1)	0.096
	R2	36 (37.9)	30 (27.5)	66 (32.4)	
	R3	28 (29.5)	32 (29.4)	60 (29.4)	
	R4	10 (10.5)	25 (22.9)	35 (17.2)	
Number of obstetric patients seen per week	0 patient	8 (8.4)	31 (28.4)	39 (19.1)	<0.001
	3-5 patients	41 (43.2)	63 (57.8)	104 (51.0)	
	> 5 patients	46 (48.4)	15 (13.8)	61 (29.9)	

In table 2, it showed the availability of tests used for detecting DM and ability of the primary care center to deal with diabetic patients among the two clusters. In general, the most available tests for diabetes mellitus in both groups was random BGL (84.3%) followed by fasting BGL (79.4%) and HBA1c (65.2%) while availability of using 50 gm glucose challenge test and 75 gm glucose tolerance test were 6.4% and 22.1%, respectively. No significant difference was noticed in the answers of both clusters except for availability of fasting BGL and HbA1c which was higher in cluster 2 (Fasting BGL 87.2% vs 70.5%, P=0.003) (HbA1C 77.1% vs 51.6%, P<0.001). It was found that 45.1% of the participants reported that there is no dietitian or diabetes/health educators in their primary care centers, where cluster two had more numbers of dietitian, or health/diabetes educators in their centers (50.5% vs 27.4%, P=0.001). Furthermore, 48% of the participants reported neutral confident of their skills in managing diabetes mellitus where 32.3% of them reported that they are not confident with no significant difference between two clusters (P=0.104). Moreover, 25% of the total sample believe that the patients do not receive appropriate care for their DM during pregnancy which was reported more in cluster one (P=0.008). Finally, 36.3% of the participants reported that they routinely screen any women for diabetes early in pregnancy at their first visit where residents of cluster two showed significantly higher screening rates (Table 2).

Table 2 Tests available in your primary care center/ Hospital across two Health Clusters

Characteristics	Description	Cluster I [95 (46.6)]	Cluster II [109 (53.4)]	Total [204 (100.0)]	p value
Tests available in your primary care center/ Hospital	HbA1c	49 (51.6)	84 (77.1)	133 (65.2)	<0.001
	Fasting BGL	67 (70.5)	95 (87.2)	162 (79.4)	0.003
	Random BGL	77 (81.1)	95 (87.2)	172 (84.3)	0.232
	50 gm Glucose Challenge Test	6 (6.3)	7 (6.4)	13 (6.4)	0.975
	75 gm Glucose Tolerance Test	24 (25.3)	21 (19.3)	45 (22.1)	0.303
Is there a dietitian, health educator or diabetes educator in your primary care center/Hospital?	No	59 (62.1)	33 (30.3)	92 (45.1)	<0.001
	Yes	26 (27.4)	55 (50.5)	81 (39.7)	
	Unsure	10 (10.5)	21 (19.3)	31 (15.2)	
How confident are you in your own skills to manage women with diabetes in pregnancy?	Not at all confident	3 (3.2)	3 (2.8)	6 (2.9)	0.104
	Not confident	27 (28.4)	33 (30.3)	60 (29.4)	
	Neutral	53 (55.8)	45 (41.3)	98 (48.0)	
	Confident	12 (12.6)	26 (23.9)	38 (18.6)	
	Extremely confident	0 (.0)	2 (1.8)	2 (1.0)	
Do you believe most women in your health service receive appropriate care for diabetes during pregnancy?	Strongly disagree	4 (4.2)	1 (.9)	5 (2.5)	0.008
	Disagree	26 (27.4)	20 (18.3)	46 (22.5)	
	Neutral	54 (56.8)	59 (54.1)	113 (55.4)	
	Agree	10 (10.5)	26 (23.9)	36 (17.6)	
	Strongly agree	1 (1.1)	3 (2.8)	4 (2.0)	
Do you routinely screen any women for diabetes early in pregnancy (at first visit or soon after)?	No	55 (57.9)	43 (39.4)	98 (48.0)	0.008
	Yes	24 (25.3)	50 (45.9)	74 (36.3)	
	Unsure	16 (16.8)	16 (14.7)	32 (15.7)	

The main target population for screening DM at the first trimester according to total sample was for all pregnant women (49%), pregnant women with personal history of DM (49%), and pregnant women with family history of DM (35.8%) and obese women (29.9%). Among cluster 1 participants, 64.2% would screen all pregnant women for DM at the first trimester, while among participants at cluster 2; pregnant women with personal history of GDM or glucose intolerance were the main targeted population (67.9%) (Figure 1). Considering screening for GDM in pregnant women at second and third trimester, 85.3% of the total participants would screen all pregnant women at gestational age of 24 – 28 weeks with no significant difference between participants of both clusters (P=0.243).

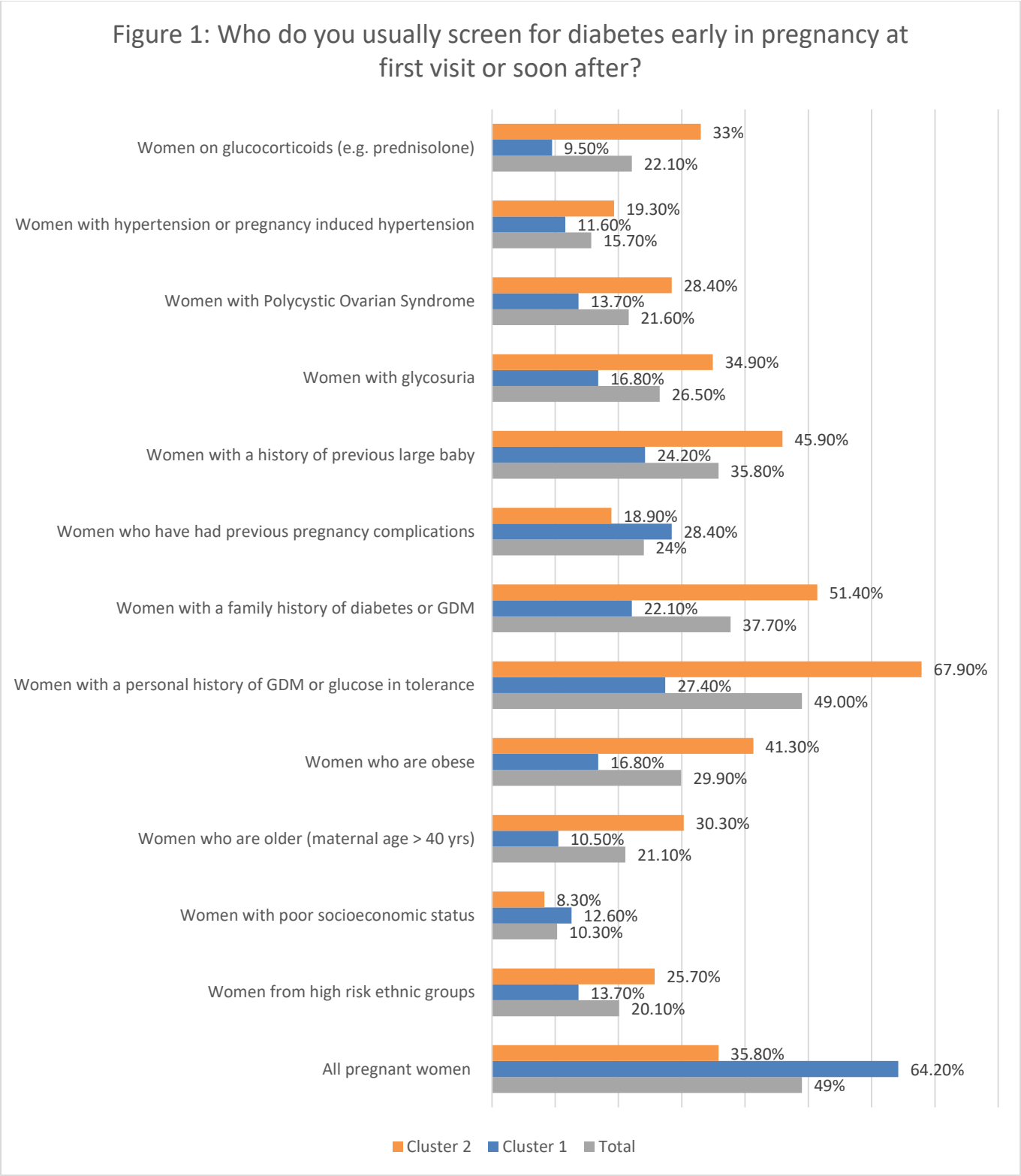

Figure 1 Who do you usually screen for diabetes early in pregnancy at first visit or soon after?

The main used screening tool was 75 gm Glucose Tolerance Test (63.2%). However, 49.5% of the participants of cluster one used this method compared with 75.2% of the participants in cluster two (P<0.001). Moreover, only 20.6% of the participants used the handheld record carried by the pregnant women with no difference between the two clusters (P=0.878). 11.6% of total sample reported that they always write in the handheld antenatal record, 27.1% of cluster two participants vs 1.1% of cluster one. Considering referral process, 18.6% of the participants refer pregnant women to medical specialists most of the time with significant difference between the two clusters, 30.3% of cluster two compared with 5.3% of cluster one would refer patients most of the time (P=0.001). Most of the participants would refer patients to obstetrics and gynecology specialists with no significant difference between two clusters (P=0.51) (Table 3).

Table 3 Participants' attitude toward screening DM and referral process

Characteristics	Description	Cluster I	Cluster II	Total	p value
At what gestation do you aim to screen for diabetes in the second or third trimester?	< 24 weeks	2 (2.1)	3 (2.8)	5 (2.5)	0.243
	24-28 weeks	77 (81.1)	97 (89.0)	174 (85.3)	
	26-28 weeks	13 (13.7)	6 (5.5)	19 (9.3)	
	28 weeks	3 (3.2)	3 (2.8)	6 (2.9)	
What screening test do you most commonly use in the second and third trimester?	HbA1c	7 (7.4)	5 (4.6)	12 (5.9)	<0.001
	Random BGL	25 (26.3)	3 (2.8)	28 (13.7)	
	Fasting BGL	10 (10.5)	7 (6.4)	17 (8.3)	
	50 gm Glucose Challenge Test	3 (3.2)	9 (8.3)	12 (5.9)	
	75 gm Glucose Tolerance Test	47 (49.5)	82 (75.2)	129 (63.2)	
	Unsure	3 (3.2)	3 (2.8)	6 (2.9)	
Do you currently use the handheld record (carried by pregnant women)?	Yes	20 (21.1)	22 (20.2)	42 (20.6)	0.878
Do you currently write in the handheld antenatal record :	Never	7 (8.0)	17 (28.8)	24 (16.4)	<0.001
	Rarely	13 (14.9)	11 (18.6)	24 (16.4)	
	Sometime	66 (75.9)	15 (25.4)	81 (55.5)	
	Always	1 (1.1)	16 (27.1)	17 (11.6)	
Do you ever refer pregnant women to medical specialists (e.g. Endocrinologist? Obstetrician)	Never	8 (8.4)	18 (16.5)	26 (12.7)	<0.001
	Rarely	12 (12.6)	16 (14.7)	28 (13.7)	
	Sometime	70 (73.7)	42 (38.5)	112 (54.9)	
	Most of the time	5 (5.3)	33 (30.3)	38 (18.6)	
If you ever referred, please specify to which specialists.	Endocrinologist	1 (10.0)	5 (12.5)	6 (12.0)	0.51
	Endocrinologist and Obstetrician	2 (20.0)	8 (20.0)	10 (20.0)	
	Internist	0 (.0)	1 (2.5)	1 (2.0)	
	Obstetrics and gynecology	7 (70.0)	26 (65.0)	33 (66.0)	

The main reason for referring pregnant women to specialist according to the total sample was gestational diabetes (51.0%) with no significant difference between the two clusters. Other reasons included preeclampsia (48.0%), UTI (45.6%), small for gestational age (43.1%), and threatened abortion (43.1%) with no significant difference between the two clusters. A significant difference had been found between the two clusters, 38.9% of cluster one would refer pregnant women if they had parity of more than 7 compared with 18.3% of cluster two (P=0.001), anemia (32.6% vs 14.7%, P=0.002), while 42.2% participants of cluster two would refer patients with sickle cell anemia compared with 22.1% of cluster one (P=0.002) (Figure 2).

Considering satisfaction of participants with the referring process to medical specialists, we found that 25.5% of the participants were dissatisfied with referring process with significant differences between the two clusters, while participants of cluster two were more satisfied with the referring process (P=0.01). Moreover, 13.7% of the participants were satisfied with communication they received back from medical specialists where the participants of cluster two were less satisfied with this process (P=0.001). Considering referring pregnant women to allied health specialists, 49.0% of the total participants answered with yes with no

significant difference between the two clusters (P=0.065), participants of cluster one were more satisfied with referring process (P=0.01) and communication they received back (P<0.001) (Table 4).

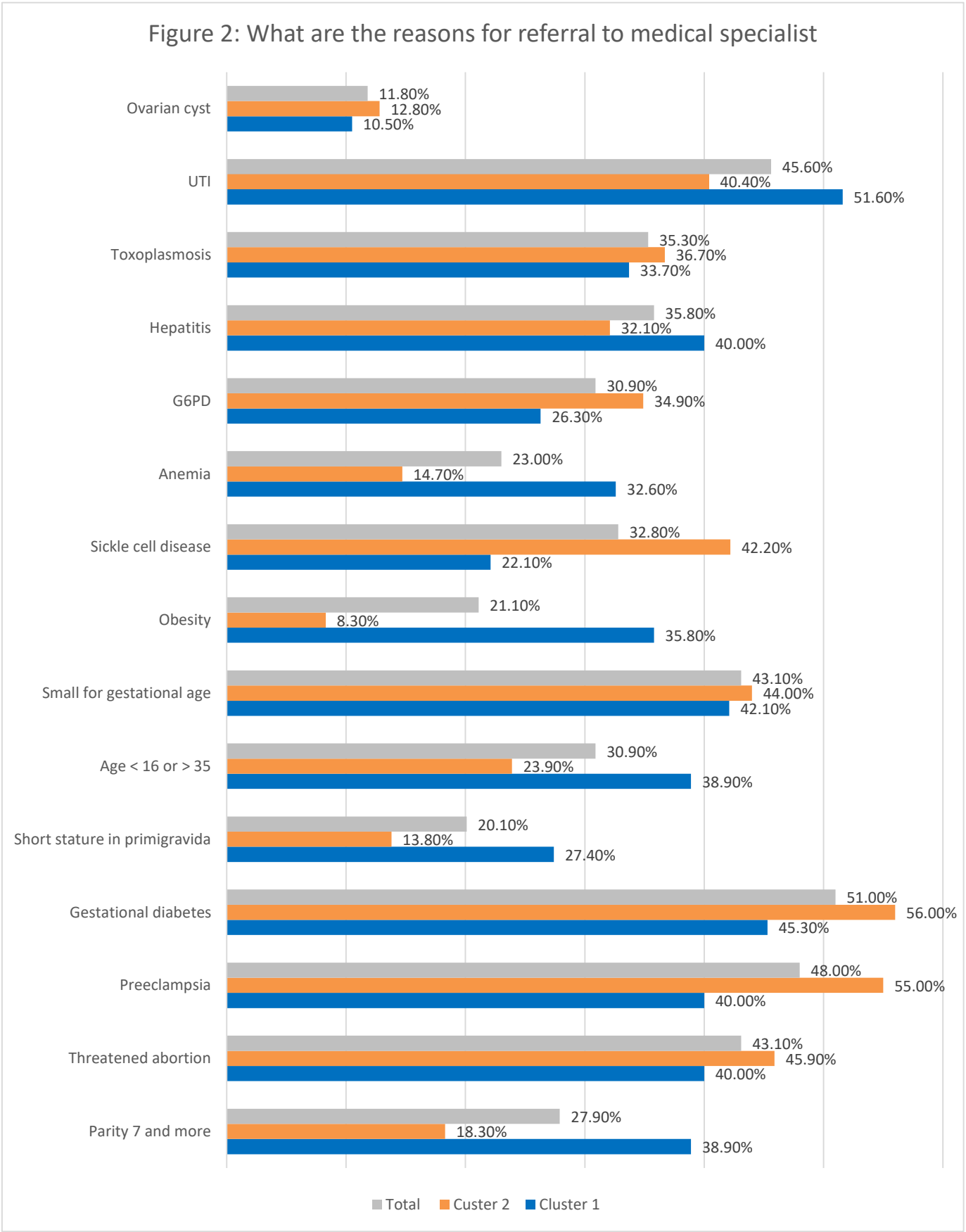

Figure 2 What are the reasons for referral to medical specialist

Table 4 The satisfaction of the participants with referring process					
Characteristics	Description	Cluster I	Cluster II	Total	p value
How satisfied are you with the process of referring to medical specialists?	Non-applicable	0 (.0)	2 (1.8)	2 (1.0)	0.01
	Very dissatisfied	1 (1.1)	12 (11.0)	13 (6.4)	
	Dissatisfied	20 (21.1)	19 (17.4)	39 (19.1)	
	Neutral	60 (63.2)	54 (49.5)	114 (55.9)	
	Satisfied	11 (11.6)	20 (18.3)	31 (15.2)	
	Very satisfied	3 (3.2)	2 (1.8)	5 (2.5)	
How satisfied are you with the communication you receive back from medical specialists?	Non-applicable	0 (.0)	10 (9.2)	10 (4.9)	<0.001
	Very dissatisfied	6 (6.3)	29 (26.6)	35 (17.2)	
	Dissatisfied	22 (23.2)	20 (18.3)	42 (20.6)	
	Neutral	50 (52.6)	39 (35.8)	89 (43.6)	
	Satisfied	16 (16.8)	11 (10.1)	27 (13.2)	
	Very satisfied	1 (1.1)	0 (.0)	1 (.5)	
Do you ever refer pregnant women to allied health specialists? (e.g. dietitian, diabetes educator)	Yes	40 (42.1)	60 (55.0)	100 (49.0)	0.065
How satisfied are you with the process of referring to allied health specialists?	Non-applicable	1 (1.1)	8 (7.3)	9 (4.4)	0.01
	Very dissatisfied	0 (.0)	12 (11.0)	12 (5.9)	
	Dissatisfied	14 (14.7)	11 (10.1)	25 (12.3)	
	Neutral	54 (56.8)	55 (50.5)	109 (53.4)	
	Satisfied	23 (24.2)	19 (17.4)	42 (20.6)	
	Very satisfied	3 (3.2)	4 (3.7)	7 (3.4)	
How satisfied are you with the communication you receive back from allied health specialists?	Non-applicable	1 (1.1)	9 (8.3)	10 (4.9)	<0.001
	Very dissatisfied	0 (.0)	16 (14.7)	16 (7.8)	
	Dissatisfied	18 (18.9)	15 (13.8)	33 (16.2)	
	Neutral	48 (50.5)	53 (48.6)	101 (49.5)	
	Satisfied	26 (27.4)	13 (11.9)	39 (19.1)	
	Very satisfied	2 (2.1)	3 (2.8)	5 (2.5)	

Mainly, most of the participants depend on Up-to-date online website as a resource for information about DM on a regular basis (72.1%) followed with medical databases as PubMed (53.9%). We found that 54.7% of the participants in cluster one would depend on primary clinical care manual and chronic disease manual compared with 4.7% of cluster two (p=0.001), and 35.8% used Qld statewide clinical networks compared with 2.8% (P=0.001) (Figure 3). Moreover, 46.6% of the participants reported that sometimes they use pamphlets, brochures flip charts or online resources for client education with significant differences between two clusters (P=0.001). Personal education using journals was the most preferred tool for professional education about DM in pregnancy (32.4%) followed by lectures (29.9%) and online modules (26%).

Furthermore, 58.3% of the participants reported seen 0-20% of the pregnant women prior to the pregnancy for pre-pregnancy counseling with significant difference between two clusters 68.8% of cluster two compared with 46.3% of cluster one, (P=0.003). Moreover, 55.4% of the participants reported seeing 0-20% of the pregnant women for ongoing clinical care. We found that 62.7% reported that they sometime thought that medical specialists should be involved in management of pregnant women with DM, 42.2% of cluster 2 thought that specialists should be involved most of the time compared with 15.8% of the cluster 1 (P=0.0001) (Table 5).

Table 5 Residents attitude and practice considering patients' education					
For client education on any topic how often do you use	Never	5 (5.3)	24 (22.0)	29 (14.2)	<0.001
	Frequently (a few times a	2 (2.1)	3 (2.8)	5 (2.5)	

pamphlets, brochures, flip-charts or online resources?	week)				
	Occasionally	26 (27.4)	39 (35.8)	65 (31.9)	
	Often (weekly)	3 (3.2)	7 (6.4)	10 (4.9)	
	Sometimes (monthly)	59 (62.1)	36 (33.0)	95 (46.6)	
What is your preference for professional education about diabetes in pregnancy?	Course	7 (7.4)	13 (11.9)	20 (9.8)	<0.001
	Lecture or talk by specialist	21 (22.1)	40 (36.7)	61 (29.9)	
	Online modules	38 (40.0)	15 (13.8)	53 (26.0)	
	Personal Learning (e.g. journal articles, textbook)	29 (30.5)	37 (33.9)	66 (32.4)	
	As a part of a conference or symposium	0 (.0)	4 (3.7)	4 (2.0)	
Approximately what percentage of the pregnant women you work with have you seen prior to their pregnancy specifically for pre-pregnancy counselling?	0-20%	44 (46.3)	75 (68.8)	119 (58.3)	0.003
	20-40%	37 (38.9)	20 (18.3)	57 (27.9)	
	40-60%	11 (11.6)	13 (11.9)	24 (11.8)	
	60-80%	2 (2.1)	1 (.9)	3 (1.5)	
	80-100%	1 (1.1)	0 (.0)	1 (.5)	
Approximately what percentage of pregnant women you work with do you see post-partum for ongoing clinical care? (e.g. 6 week check)	0-20%	46 (48.4)	67 (61.5)	113 (55.4)	0.021
	20-40%	31 (32.6)	28 (25.7)	59 (28.9)	
	40-60%	12 (12.6)	14 (12.8)	26 (12.7)	
	60-80%	6 (6.3)	0 (.0)	6 (2.9)	
	80-100%	0 (.0)	0 (.0)	0 (.0)	
Do you think medical specialists (e.g. Endocrinologists, Obstetricians) should be involved in managing women with diabetes in pregnancy	Most of the time	15 (15.8)	46 (42.2)	61 (29.9)	<0.001
	Sometime	73 (76.8)	55 (50.5)	128 (62.7)	
	Rarely	7 (7.4)	6 (5.5)	13 (6.4)	
	Never	0 (.0)	2 (1.8)	2 (1.0)	

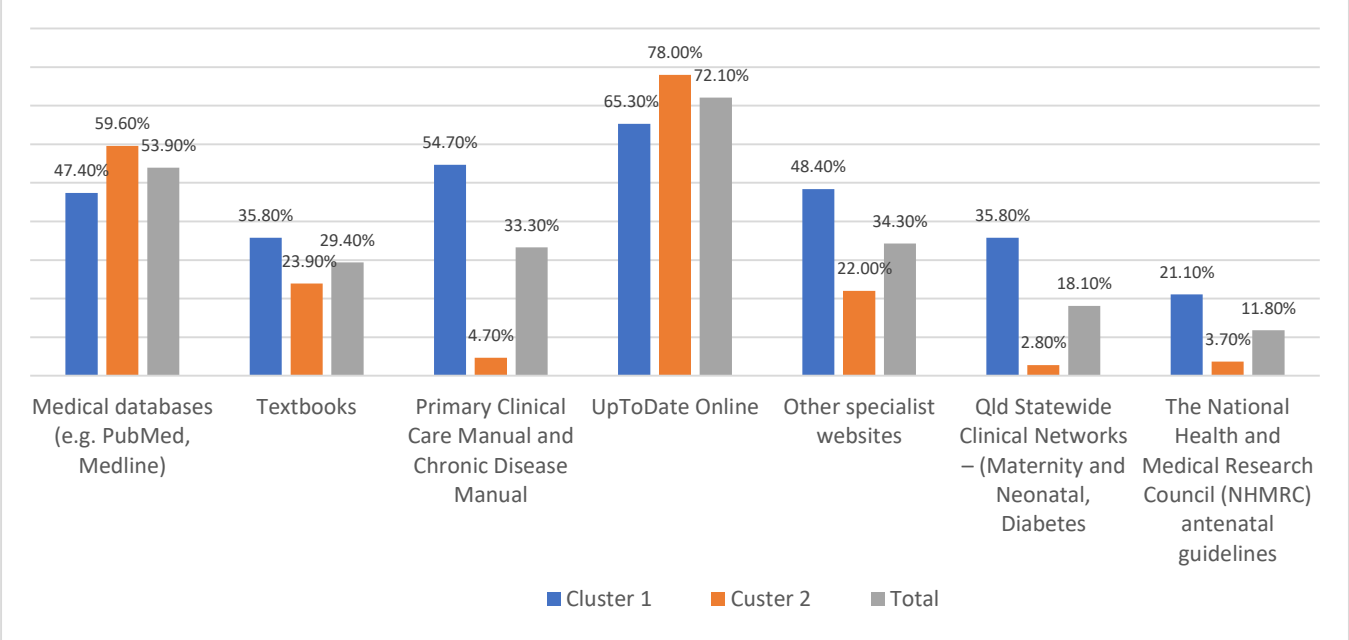

Figure 3 what professional educational resources do you use on a regular basis?

Table 6 The participants' report about their confidence toward management of diabetes in pregnancy					
Characteristics	Description	Cluster I	Cluster II	Total	p value
How confident are you in providing general lifestyle advice (e.g. smoking, exercise, infection prevention) to pregnant women with diabetes?	Not at all confident	1 (1.1)	2 (1.8)	3 (1.5)	0.002
	Not confident	15 (15.8)	7 (6.4)	22 (10.8)	
	Neutral	40 (42.1)	27 (24.8)	67 (32.8)	
	Confident	28 (29.5)	44 (40.4)	72 (35.3)	
	Very confident	11 (11.6)	27 (24.8)	38 (18.6)	
	Not applicable	0 (.0)	2 (1.8)	2 (1.0)	
How confident are you in providing education about dietary management for pregnant women with diabetes?	Not at all confident	0 (.0)	6 (5.5)	6 (2.9)	0.04
	Not confident	6 (6.3)	14 (12.8)	20 (9.8)	
	Neutral	47 (49.5)	41 (37.6)	88 (43.1)	
	Confident	33 (34.7)	33 (30.3)	66 (32.4)	
	Very confident	9 (9.5)	14 (12.8)	23 (11.3)	
	Not applicable	0 (.0)	1 (.9)	1 (.5)	
How confident are you in providing education about monitoring of blood glucose levels to pregnant women?	Not at all confident	0 (.0)	2 (1.8)	2 (1.0)	0.035
	Not confident	7 (7.4)	12 (11.0)	19 (9.3)	
	Neutral	44 (46.3)	29 (26.6)	73 (35.8)	
	Confident	35 (36.8)	48 (44.0)	83 (40.7)	
	Very confident	9 (9.5)	16 (14.7)	25 (12.3)	
	Not applicable	0 (.0)	2 (1.8)	2 (1.0)	
How confident are you in providing education about administration and storage of insulin?	Not at all confident	0 (.0)	7 (6.4)	7 (3.4)	<0.001
	Not confident	7 (7.4)	24 (22.0)	31 (15.2)	
	Neutral	38 (40.0)	36 (33.0)	74 (36.3)	
	Confident	44 (46.3)	27 (24.8)	71 (34.8)	
	Very confident	6 (6.3)	14 (12.8)	20 (9.8)	
	Not applicable	0 (.0)	1 (.9)	1 (.5)	

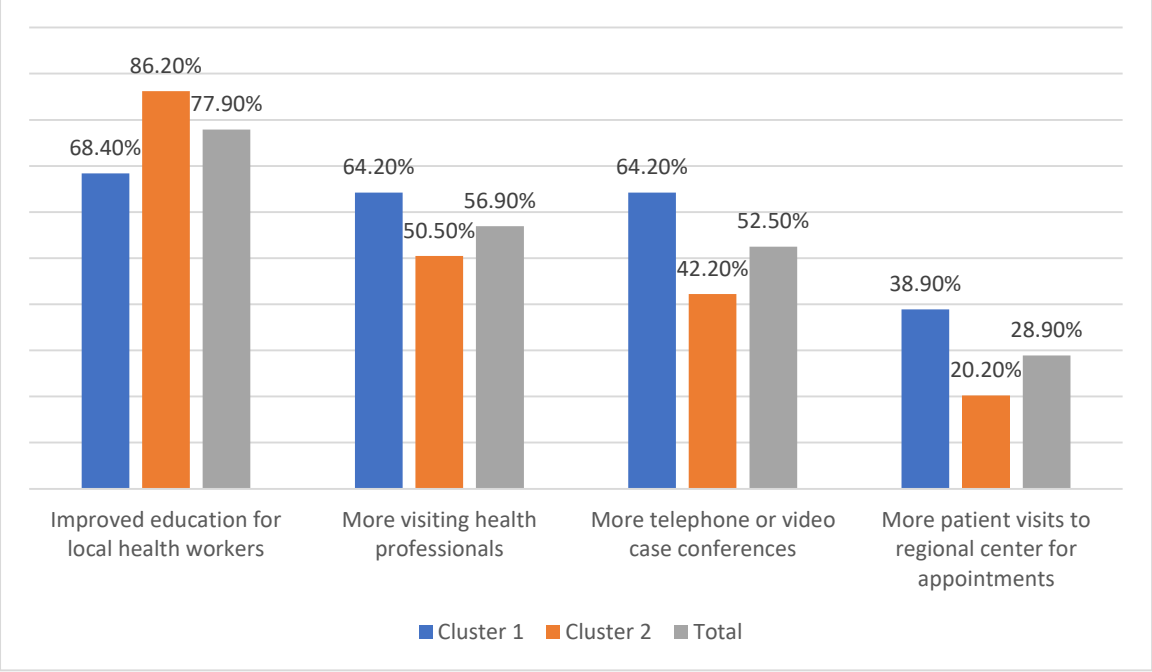

Figure 4 Do you think women with diabetes in pregnancy would benefit from any of the following?

We found that 53.9% of the participants were confident with providing general lifestyle advices for pregnant women with diabetes, 43.7% were confident with providing education about dietary management, 53% were confident with providing education about monitoring of blood glucose levels and 44.6% were confidents with providing education about administration and storage of insulin. A significant difference had been found between the participants of the two clusters, participants of cluster two were more confident with providing general lifestyle advices, and cluster one were more confident toward providing education about administration and storage of insulin (Table 6 and Figure 4).

Finally, we found that most of the participants thought that pregnant women with diabetes would benefit from improved education for local health workers (77.9%), more visiting health professionals (56.9%) and more telephone or video case conferences (52.5%).

4. DISCUSSION

Gestational diabetes is considered one of the prevalent conditions that occur among pregnant women and has significant negative impact on mothers and their fetus. Clear evidence was found to confirm the continuum of risks associated with increasing carbohydrate intolerance for both mothers and fetus (Dodd et al., 2007; Metzger et al., 2008). In the mother, evidence provides support for the relationship between GDM and elevated rates of caesarean birth and pre-eclampsia (Wendland et al., 2012). There are strong connections between GDM and the future development of type 2 diabetes, within 10 years women who developed GDM, half of them develop type 2 diabetes (Kim et al., 2002). Also, there is growing evidence that women who have a personal history of GDM are at increased risk of cardiovascular disease and metabolic syndrome (Reece, 2010; Reece et al., 2009). Screening is intended to identify the disease earlier before symptoms occur. Identification of disease by screening makes it possible for earlier management leading to better health outcomes. The objective of this study was to assess, compare, and to correlate between the knowledge and practice of family medicine residents towards screening for gestational diabetes mellitus and undiagnosed DM in 1st and 2nd health clusters, Riyadh, Kingdom of Saudi Arabia.

In this study we found that 85% of the residents in both clusters have the correct knowledge about screening of GDM between 24-28 weeks of pregnancy. A Moroccan study done among primary health care providers to study the knowledge and practice related to GDM found that 53.3% of the participants will screen for GDM in the second trimester (Utz et al., 2017). In the present study it was revealed that there was limited knowledge and practice regarding screening of undiagnosed diabetes mellitus in patients with increased risk factors at their first antenatal visit. The same was found in an Australian study done to study the improving models of care for diabetes in pregnancy, they found that majority of the responders will screen for GDM between 24-28 weeks, however there was uncertainty about screening for undiagnosed diabetes mellitus in early pregnancy (McLean et al., 2019).

The most accurate tool for diagnosis of GDM is using of 75 g or 100 g oral glucose tolerance test (OGTT) as well as assessment of clinical risk factors (Agarwal, 2016). In our study, we found that the most available tests for diabetes mellitus in each group was random BGL followed by fasting BGL and HBA1c, while availability of using 50gm glucose challenge test and 75gm glucose tolerance test were 6.4% and 22.1%, respectively. Availability of appropriate screening tool and tests used for diabetes in pregnancy is externally important for an early detection and diagnosis.

The most used tool to screen for GDM in second and third trimester was 75gm Glucose Tolerance Test, and it is used more in cluster two. The same test was used by the participants to screen for undiagnosed diabetes in early pregnancy but to a lesser extent (63.2% vs 32.8%). Similar finding was found in the Austrian study (McLean et al., 2019). Older age, family history of GDM or type 2 diabetes, overweight or obese and previous history of macrosomia are main risk factors for GDM (Utz et al., 2017). In this study, less than half of the sample would consider personal history of GDM, family history of DM and obesity as risk factors for GDM.

We found that only 29.4% of the residents in this study reported that they are not confident of their skills in managing diabetes mellitus in pregnancy. Another finding of this study that 25% of total sample denied that the patients are taking the appropriate care for their DM which is reported more in cluster one. This difference could be explained by the availability of tests and higher numbers of dietitians and health/diabetes educators in cluster two. Considering referral process, 18.6% of the participants refer pregnant women to medical specialists most of the time with significant difference between the two clusters, 30.3% of cluster two compared with 5.3% of cluster one would refer patients most of the time especially to obstetrics and gynecology specialists.

The main reasons for referrals were gestational diabetes, preeclampsia, and medical diseases (DM, HTN, CHD, and CKD). We found that participants of cluster two have higher satisfaction with referring process to medical specialists however; they were less satisfied with the communication they received back from medical specialists. Up-to-date online website was the main resource of education used by the participants on regular basis. Moreover, we found that one third to half of the residents in this study are confident to educate and manage patients with diabetes in pregnancy.

This study has some limitations. One of the limitations is using self-reported questionnaire which could lead to some personal bias where some participants may not complete the questionnaire. As this study was targeting residents only, the results can't be generalized on other health care providers. We recommend conducting a larger scaled study on other health care providers.

5. CONCLUSION

Most of the participants had good knowledge toward appropriate timing and suitable test for GDM screening, as well as indications for referral of pregnant ladies to other specialties. On the other hand, there was a limited knowledge about screening for undiagnosed diabetes in pregnancy. We found that almost half of the residents in both clusters are confident in the management of diabetes in pregnancy.

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Conflicts of interest

The authors declare that there are no conflicts of interests.

Data and materials availability

All data associated with this study are present in the paper.

REFERENCES AND NOTES

1. Abdelmola AO, Mahfouz MS, Gahtani MAM, Mouharrq YJ, Hakami BHO, Daak OI, Alharbi AQ, Masmali UMA, Melassy DAM, Alhazmi AA. Gestational diabetes prevalence and risk factors among pregnant women-Jazan Region, Saudi Arabia. Clinical Diabetol 2017; 6(5):172-177 doi: 10.5603/DK.2017.0028
2. Agarwal MM. Gestational diabetes mellitus: Screening with fasting plasma glucose. World J Diabetes 2016; 7(14): 279-289. doi: 10.4239/wjd.v7.i14.279
3. Al-Rifai RH, Majeed M, Qambar MA, Ibrahim A, AlYammahi KM, Aziz F. Type 2 diabetes and pre-diabetes mellitus: a systematic review and meta-analysis of prevalence studies in women of childbearing age in the Middle East and North Africa, 2000-2018. Syst Rev 2019; 8(1): 268. doi: 10.1186/s13643-019-1187-1
4. Al-Rubeaan K, Al-Manaa HA, Khoja TA, Youssef AM, Al-Sharqawi AH, Siddiqui K, Ahmad NA. A community-based survey for different abnormal glucose metabolism among pregnant women in a random household study (SAUDI-DM). BMJ Open 2014; 4(8):e005906. doi: 10.1136/bmjopen-2014-005906
5. Dodd JM, Crowther CA, Antoniou G, Baghurst P, Robinson JS. Screening for gestational diabetes: the effect of varying blood glucose definitions in the prediction of adverse maternal and infant health outcomes. Aust N Z J Obstet Gynaecol 2007; 47(4): 307-312. doi: 10.1111/j.1479-828X.2007.00743.x
6. Kim C, Newton KM, Knopp RH. Gestational diabetes and the incidence of type 2 diabetes: a systematic review. Diabetes Care 2002; 25(10): 1862-1868. doi: 10.2337/diacare.25.10.1862
7. Lee D, Booth GL, Ray JG, Ling V, Feig DS. Undiagnosed type 2 diabetes during pregnancy is associated with increased perinatal mortality: a large population-based cohort study in Ontario, Canada. Diabet Med 2020; 37(10): 1696-1704. doi: 10.1111/dme.14250
8. Madanat AY, Sheshah EA. Preconception care in Saudi women with diabetes mellitus. J Family Community Med 2016; 23(2): 109-114. doi: 10.4103/2230-8229.181012
9. McLean A, Kirkham R, Campbell S, Whitbread C, Barrett J, Connors C, Boyle J, Brown A, Mein J, Wenitong M, McIntyre HD, Barzi F, Oats J, Sinha A, Maple-Brown L. Improving Models of Care for Diabetes in Pregnancy: Experience of Current Practice in Far North Queensland, Australia [Original Research]. Frontiers Pub Health 2019; 7. doi: 10.3389/fpubh.2019.00192
10. Metzger BE, Lowe LP, Dyer AR, Trimble ER, Chaovarindr U, Coustan DR, Hadden DR, McCance DR, Hod M, McIntyre HD, Oats JJ, Persson B, Rogers MS, Sacks DA. Hyperglycemia and adverse pregnancy outcomes. N Engl J Med 2018; 358(19): 1991-2002. doi: 10.1056/NEJMoa0707943

11. Reece EA, Leguizamón G, Wiznitzer A. Gestational diabetes: the need for a common ground. Lancet 2009; 373(9677): 1789-1797. doi: 10.1016/s0140-6736(09)60515-8
12. Reece EA. The fetal and maternal consequences of gestational diabetes mellitus. J Matern Fetal Neonatal Med 2010; 23(3): 199-203. doi: 10.3109/14767050903550659
13. Utz B, Assarag B, Essolbi A, Barkat A, Delamou A, De Brouwere V. Knowledge and practice related to gestational diabetes among primary health care providers in Morocco: Potential for a defragmentation of care? Prim Care Diabetes 2017; 11(4): 389-396. doi: 10.1016/j.pcd.2017.04.005
14. Wendland EM, Torloni MR, Falavigna M, Trujillo J, Dode MA, Campos MA, Duncan BB, Schmidt MI. Gestational diabetes and pregnancy outcomes--a systematic review of the World Health Organization (WHO) and the International Association of Diabetes in Pregnancy Study Groups (IADPSG) diagnostic criteria. BMC Pregnancy Childbirth 2012; 12: 23. doi: 10.1186/1471-2393-12-23
15. WHO. Diabetes 2020. https://www.who.int/news-room/fact-sheets/detail/diabetes
16. WHO. Eastern Mediterranean Region [Internet] 2010. http://www.emro.who.int/emhj-volume-16-2010/volume-16-issue-6/article-09.html
17. Zhu Y, Zhang C. Prevalence of Gestational Diabetes and Risk of Progression to Type 2 Diabetes: a Global Perspective. Curr Diab Rep 2016; 16(1): 7. doi: 10.1007/s11892-015-0699-x